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PROCESS FOR THE PREPARATION OF SULFONATED DETERGENT COMPOSITION

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ABSTRACT OF THE DISCLOSURE

A process for preparing a water-soluble sulfonated reaction product having excellent detergent properties which uses alpha-olefins as the starting reactant. The process comprises, as the first step, reacting each mole of alpha-olefin with 1.0 to 1.25 moles sulfur trioxide in a film reactor under process conditions of a reaction time of between 12 seconds and 50 seconds, a temperature of 32° F. to 180° F., and a pressure of 8 p.s.i.g. to 20 p.s.i.g. at the top of the reactor. This reaction mix is thereafter immediately reacted with a lower alcohol and is then neutralized and hydrolyzed to produce a valuable detergent composition.

BACKGROUND OF THE INVENTION

This invention relates to an improved process for the preparation of an organic water-soluble sulfonated reaction product which has valuable detergent properties and is thus useful as a detergent composition.

While sulfonated detergent compounds and processes for their preparation have been known and used for many years, there is a continuing need and demand for improved processes and products. Few of the known processes have been completely successful in meeting the rigid requirements of economics and performance results imposed by the soap and detergent industry. For instance, while some sulfonation processes claim to provide detergent products of high quality, they are generally difficult to control and are inordinately costly. The products of these reactions are frequently expensive, as a result of which, such processes have not found wide commercial acceptance in the industry since the economic factor is so important. Yet other processes, which reputedly solve the problem of cost, are subject to the objection that they produce reaction products of generally inferior quality. Still other known processes have limitations in that while they offer quality products at a reasonable cost, they cannot be scaled up to satisfy production line requirements of a uniform high quality product.

Accordingly, it is a primary and major object of the present invention to provide an improved process for the preparation of an organic water-soluble sulfonated reaction product which has outstanding detergent properties. Another object is to provide such an improved process which is inexpensive and which also is easy to perform. A further object of the present invention is to provide a process for the conversion of alpha olefin hydrocarbons into valuable detergent compositions, which process can be readily scaled up to factory requirements with a minimum of effort and without an adverse effect on cost factors or sacrifice to the uniform high quality of the reaction product. Yet another object of the present invention is to provide an inexpensive, continuous process for the preparation of a sulfonated alpha olefin reaction product having valuable detergent properties. Other objects will become apparent from the following detailed description of the present invention.

All percentages used hereinafter in the specification and claims are by weight unless otherwise specified.

SUMMARY OF THE INVENTION

A process for preparing a water-soluble sulfonated reaction product, comprising the steps of:

(a) Reacting an alpha-olefin containing from 10 to 20 carbon atoms with sulfur trioxide in a film reactor at a temperature of from 32° F. to 180° F., a pressure at the top of reactor of from 8 p.s.i.g. to 20 p.s.i.g., a reaction time of from 12 seconds to 50 seconds and wherein from 1.0 mole to 1.25 moles of the sulfur trioxide is reacted with each mole of the alpha-olefin to produce a sulfonated mix;

(b) Immediately reacting the sulfonated mix of step (a) with a lower alcohol having from 1 to 4 carbon atoms;

(c) Neutralizing the product of step (b) with an alkali solution; and

(d) Hydrolyzing the product of step (c) to obtain the water-soluble sulfonated reaction product comprising the water-soluble salts of from 40% to 55% alkene-1-sulfonate, from 20% to 40% of 2-alkoxy alkane-1-sulfonate wherein the alkoxy radical contains from 1 to 4 carbon atoms, from 10% to 20% of 3- and 4-hydroxy alkane-1-sulfonate, and from 2% to 15% of alkene disulfonate wherein the sulfonated chains all have from 10 to 20 carbon atoms.

DETAILED DESCRIPTION OF THE INVENTION

The process of this invention results in a very efficient detergent composition having use per se or as part of a built detergent formulation. In particular the resultant product of this novel process consists essentially of from 40% to 55% of a water-soluble salt of alkene-1-sulfonate, from 20% to 40% of a water-soluble salt of 2-alkoxy alkane-1-sulfonate wherein the alkoxy radical contains from 1 to 4 carbon atoms, from 10% to 20% of the water-soluble salts of 3- and 4-hydroxy alkane-1-sulfonate, and from 2% to 15% of a water-soluble salt of an alkene disulfonate wherein one sulfonate radical is attached to a terminal carbon atom and the other sulfonate radical is attached to a carbon atom not more than three carbon atoms removed from the said terminal carbon atom. All of the above aforementioned compounds have sulfonated chains containing from 10 to 20 carbon atoms. Additionally, the alkene double bond of the alkene-1-sulfonate and alkene disulfonate is distributed between the terminal carbon atom having attached thereto the sulfonate radical and the fifth and seventh carbon atoms, respectively. A detailed description of the end product of the process of this invention will be more fully described hereinafter. Commonly assigned concurrently filed herewith copending patent application Ser. No. 188,597, entitled "Detergent Composition" by Herbert C. Smitherman, also contains a description of the detergent composition that represents the end product of this invention.

The sulfonation reaction of the present invention is carried out in a thin film reactor. Various film sulfonation processes are generally known to those skilled in the art as well as apparatus for carrying out the process. For example, U.S. Pat. 3,531,518, Ohren et al., describes apparatus and a process for film sulfonation of an alpha-olefin reactant.

If the sulfonation reaction is carried out under certain conditions specified hereinafter, there will be obtained a reaction mix that can be converted to a valuable detergent composition. That is, if the sulfonated reaction mix is immediately reacted with a lower alcohol and then neutralized and hydrolyzed under reaction conditions fully set out hereinafter, there results a detergent composition that performs eminently well per se or when combined with a builder salt in a built detergent composition.

More particularly, in the sulfonation step of the invention, an alpha-olefin is formed into a thin flowing film on